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EXAMINER

NGUYEN, SANG H

ART UNIT PAPER NUMBER

2877

DATE MAILED: 11/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/811,738

Applicant(s)

PRINTY ET AL.

Examiner

Sang Nguyen

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 September 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 8-10, 14-16, and 20 is/are rejected.
- 7) ☒ Claim(s) 5-7, 11-13 and 17-19 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

Applicant's response to amendment filed on 09/18/06 has been entered. It is noted that the application contains claims 1-20 by the amendment filed on 09/18/06.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-3, 8-9, and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prior Art of Present Invention (figures 1-4) in view of Shishiguchi (U.S. Patent No. 6,010,914).

Regarding claims 1, 3, 9 and 14-15; Prior Art of Present Invention discloses a method for determining a germanium concentration of a silicon germanium film, said method comprising the steps of:

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providing a blank wafer of silicon (110 of figure 1) is deposited germanium to form germanium film (120 of figure 1);

measuring the germanium concentration of a silicon germanium film (120 of figure 1) by a SIMS method (130 of figure 1); and

determining said germanium concentration of said silicon germanium film by identifying a germanium concentration by an analyze results of SIMS method (140 of figure 1 and page 2 paragraph [0004] to page 3 paragraph [0008] and page 10 paragraph [0032] to page 11 paragraph [0034]). See figures 1-4.

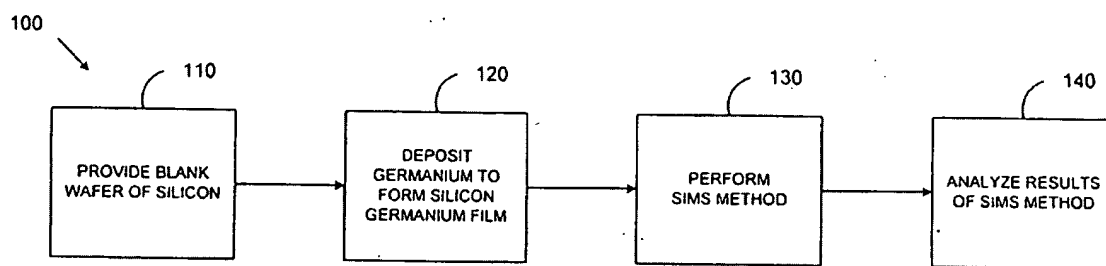
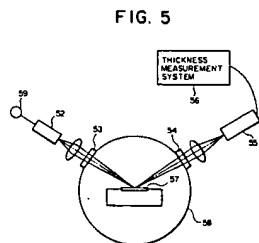
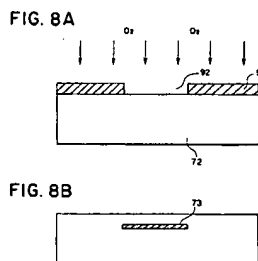


FIGURE 1
PRIOR ART

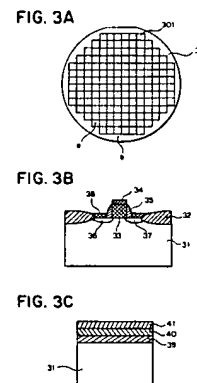
U.S. Patent Jan. 4, 2000 Sheet 1 of 1 6,010,914



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U.S. Patent Jan. 4, 2000 Sheet 2 of 1 6,010,914



PAPI discloses all of features of the claimed invention except for performing a thermal oxidation procedure on said silicon germanium film to create a layer of thermal oxide over said silicon germanium film, measuring a thickness of said layer of thermal oxide; and providing a correlation that relates a thickness of a layer of thermal oxide created over a silicon germanium film. However, Shishiguchi teaches that it is known in the art to provide apparatus and method comprising the steps of performing a thermal oxidation (figure 8A) procedure on said silicon germanium film (SiGe [40 of figure 3C]) to create a layer of thermal oxide over said silicon germanium film (figure 3C as indicated Si [31 of figure 3C], Silicon-oxide [39 of figure 3C], and SiGe [40 of figure 3C]), measuring a thickness of said layer of thermal oxide by detector (55 of figure 5) coupled to a thickness measurement system (56 of figure 5 and col.4 lines 41-60); and providing a correlation that relates a thickness of a layer of thermal oxide created over a silicon germanium film by identifying a germanium concentration (col.5 lines 38-65). See figures 1-9.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to combine method of PAPI with performing a thermal oxidation procedure on said silicon germanium film to create a layer of thermal oxide over said silicon germanium film, measuring a thickness of said layer of thermal oxide; and providing a correlation that relates a thickness of a layer of thermal oxide created over a silicon germanium film as taught by Shishiguchi for the purpose of measuring and improving accurately thickness of the epitaxial layer with an excellent reproducibility.

Regarding claims 2, 8, and 16; PAPI discloses all of features of claimed invention except for said step of measuring a thickness of said layer of thermal oxide in real time by making a plurality of thickness measurements of the thickness of the layer of thermal oxide using one an interferometer, an ellipsometer, and a spectroscopic ellipsometer. However, Shishiguchi teaches that it is known in the art to provide measuring a thickness of said layer of thermal oxide comprises measuring said thickness of said layer of thermal oxide in real time by making a plurality of thickness measurements of the thickness of the layer of thermal oxide using one an interferometer, an ellipsometer, and a spectroscopic ellipsometer (i.e., a thickness measurement equipment [56 of figure 5] using an optical interference or ellipsometry and col.4 lines 45-46). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine method of PAPI with step of measuring a thickness of said layer of thermal oxide comprises measuring said thickness of said layer of thermal oxide in real time making a plurality of thickness measurements of the thickness of the layer of thermal oxide using one an interferometer, an ellipsometer, and a spectroscopic ellipsometer as taught by Shishiguchi for the purpose of measuring and improving accurately thickness of the epitaxial layer with an excellent reproducibility.

Claims 4 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over PAPI in view of Shishiguchi as applied to claim 14 above, and further in view of Yen (U.S. Patent No. 6,639,228).

Regarding claims 4 and 10; PAPI in view of Shishiguchi discloses all of features of claimed invention except for the correlation that relates a thickness of a layer

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of thermal oxide created over a silicon germanium film to a germanium concentration is an approximately linear correlation. However, Yen teaches that it is known in the art to provide the correlation that relates a thickness of a layer of thermal oxide created over a silicon germanium film to a germanium concentration is an approximately linear correlation (figures 2-4). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine method of PAPI with the correlation that relates a thickness of a layer of thermal oxide created over a silicon germanium film to a germanium concentration is an approximately linear correlation as taught by Yen for the purpose of measuring accuracy the thickness of oxide layer after thermal process.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over PAPI in view of Shishiguchi as applied to claim 14 above, and further in view of Nozawa et al (U.S. Patent No. 6,277,657).

Regarding claim 20; PAPI in view of Shishiguchi discloses all of features of claimed invention except for exposing the silicon substrate layer to a gas comprising silane gas and germane gas in hydrogen gas carrier. However, Nozawa et al teaches that it is known in the art to provide exposing the silicon substrate layer to a gas comprising silane gas and germane gas in hydrogen gas carrier (abstract and figure 1). It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine method of PAPI with exposing the silicon substrate layer to a gas comprising silane gas and germane gas in hydrogen gas carrier as taught

by Nozawa et al for the purpose of determining a timing of switching between a process of supplying the gas to the vacuum vessel.

Allowable Subject Matter

Claims 5-7, 11-13, and 17-19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art of record, taken alone or in combination, fails to disclose or render obvious a method for determining a germanium concentration of a silicon germanium film comprising all the specific elements with the specific combination including of the step of said approximately linear correlation is described by: oxide Thickness (\AA) = $45.55035 + 2.2670656 \text{ Ge\%}$ where said term Oxide Thickness is in units of \AA s; and where said term Ge% represents a germanium concentration in a silicon germanium film in terms of germanium percentage set forth in claims 5, 11, and 17.

The prior art of record, taken alone or in combination, fails to disclose or render obvious a method for determining a germanium concentration of a silicon germanium film comprising all the specific elements with the specific combination including of the step of said approximately linear correlation is described by: Relative Oxidation Rate = $0.9795774 + 0.0487541 \text{ Ge\%}$ where said term Relative Oxidation Rate represents a ratio of a thickness of thermal oxide on a silicon wafer without a silicon germanium film; and where said term Ge% represents a germanium concentration in a silicon germanium film in terms of germanium percentage set forth in claims 6, 12, and 18.

The prior art of record, taken alone or in combination, fails to disclose or render obvious a method for determining a germanium concentration of a silicon germanium film comprising all the specific elements with the specific combination including of the step of said approximately linear correlation is described by: $\text{Ge\%} = -20.03043 + 20.470103 \text{ Relative Oxidation Rate}$, where said term Relative Oxidation Rate represents a ratio of a thickness of thermal oxide on a silicon germanium film to thickness of thermal oxide on a silicon wafer without a silicon germanium film; and where said term Ge% represents a germanium concentration in a silicon germanium film in terms of germanium percentage set forth in claims 7, 13, and 19.

said approximately linear correlation is described by: $\text{Ge\%} = -20.03043 + 20.470103 \text{ Relative Oxidation Rate}$, where said term Relative Oxidation Rate represents a ratio of a thickness of thermal oxide on a silicon germanium film to thickness of thermal oxide on a silicon wafer without a silicon germanium film; and where said term Ge% represents a germanium concentration in a silicon germanium film in terms of germanium percentage.

Response to Arguments

Applicant's arguments, see pages 10-16, filed 09/18/06, with respect to the rejection(s) of claim(s) 1-20 under PAPI in view of Rosencwaig et al [6,278,519] have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of PAPI in view of Shishiguchi (6,010,914).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Cheng et al (6573126) discloses process for producing semiconductor article; Wu et al (6521041) discloses etch stop layer system; Hang et al (5863807) discloses manufacturing method of a semiconductor integrated circuit; Naruse (5476813) discloses method of manufacturing a bonded semiconductor substrate; Kato (5298860) discloses method of analyzing metal impurities in surface oxide film; Laderman et al (5256550) discloses fabricating a semiconductor device; or Ikeda (JP 06 275 689) discloses method and apparatus for evaluating semiconductor device.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sang Nguyen whose telephone number is (571) 272-2425. The examiner can normally be reached on 9:30 am to 7:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on (571) 272-2800 ext. 77. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic


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Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

November 24, 2006


Sang Nguyen
Patent Examiner
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